APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC-1997-006

TITLE HOISTING THE PRESSURIZED MATING ADAPTER (PMA) UTILIZING THE CARGO ELEMENT LIFTING ASSEMBLY (CELA)

DOCUMENT NUMBER/TITLE L5166 - Cargo Element Lifting Assembly - O&C/SSPF

E5001 - Weight and Balance Determination, Horizontal Cargo

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REQUIRED APPROVAL

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NASA SUSPENDED LOAD OPERATION
ANALYSIS/APPROVAL

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OPERATIONS

Hoisting the Pressurized Mating Adapter (PMA) when in the horizontal configuration utilizing the Cargo Element Lifting Assembly (CELA) and PMA lifting assembly that is located in the Space Station Processing Facility (SSPF).

SUPPORTING DOCUMENTS - The associated operational procedures and System Assurance Analysis (SAA) are as follows:

- OMI L5166, Cargo Element Lifting Assembly - O&C/SSPF
- OMI E5001, Weight and Balance Determination, Horizontal Cargo
- SAA21CRS1-001, 30 Ton Highbay Bridge Cranes - Space Station Processing Facility (SSPF)

GENERAL DESCRIPTION

The PMA will be hoisted to or from the horizontal cradle or to or from the translation table.

These tasks are completed in the following OMI sequence:

- OMI L5166, Install/Remove Payload into/from TS (Test Stand), TSF (Trunnion Support Fixture), Canister, or Payload Transporter
- OMI E5001, Weighing Operations 2, 3, 4, 5

During ground processing of the PMA, it is necessary to hoist the payload in the horizontal configuration using the CELA. The following operations have been identified as requiring working under a suspended load:

1. Weight and CG operations
2. PMA saddle change-out
3. PMA horizontal handling
4. PMA-3 mate to the pallet

1. During weight and CG operations the CELA will be used to hoist the PMA out of the horizontal cradle. Four (4) technicians and one (1) task leader will be required to work under the suspended load (CELA) to guide the payload into/out of the trunnion retention fittings and to take measurements.

2. During PMA saddle change-out the CELA will be used to hoist the PMA out of the cradle assembly. Five (5) technicians and one (1) task leader will be required to work under the suspended load (CELA) to guide the payload into/out of the trunnion retention fittings and to guide the Common Berthing Mechanism (CBM) ring into/out of the saddle assembly.

3. During PMA horizontal handling the CELA will be used to hoist the PMA to or from the translation table or to or from the cradle assembly. Four (4) technicians and one (1) task leader will be required to work under the suspended load (CELA) for installation/ removal operations involving the table, cradle, or pallet. Installation/removal operations include guiding the payload into/out of the trunnion retention fittings and installing and removing attachment hardware.

4. During PMA-3 mate to the pallet the CELA will be used to hoist the PMA from the horizontal cradle to the pallet. Four (4) technicians and one (1) task leader will be required to work under the suspended load (CELA) for PMA pallet installation/removal operations. Installation/removal operations include guiding the payload into/out of the trunnion retention fittings, installing and removing attachment hardware and securing the PMA to the pallet.

RATIONALE/ANALYSIS - The suspended load tasks comply with the NASA Alternate Safety Standard as follows:

Alternate Standard Requirement #1a

These operations cannot be conducted without placing personnel under the suspended load. The CELA is required to be used to ensure that the PMA can be hoisted in the horizontal configuration with minimal risk to damage to the fight hardware.

The operations identified have been evaluated for alternate methods to complete these tasks, and it has been determined that there are no design, operational, or procedural means to eliminate personnel exposure to a suspended load. The GSE provided for the horizontal hoisting of the PMA was designed for a completely configured PMA. The PMA installation operations will be performed prior to completely configuring the PMA.

As a result of an unknown CG the use of the delivered GSE is not feasible without causing additional risk and possible damage to the flight element.

Alternate Standard Requirement #1b

The possible use of a secondary support system, to catch the load in the event of a crane failure, was analyzed. It was determined that the use of a secondary support system was not feasible due to scaffolding and access stands installed in the operation area.

Alternate Standard Requirement #1c

The maximum number of personnel permitted under the suspended load (CELA) for the various operations are as follows:

1. Weight and CG operations	4 Technicians and 1 task leader
2. PMA saddle change-out	5 Technicians and 1 task leader
3. PMA horizontal handling	4 Technicians and 1 task leader
4. PMA-3 mate to the pallet	4 Technicians and 1 task leader

Alternate Standard Requirement #1d

Performing the operations will be accomplished as quickly and safely as possible to minimize exposure time. The approximate times for the suspended load (CELA) operations are as follows:

1. Weight and CG operations	10 minutes per lift (Approximately 5 lifts are planned)
2. PMA saddle change-out	30 minutes
3. PMA horizontal handling	30 minutes
4. PMA-3 mate to the pallet	60 minutes

Alternate Standard Requirement #4

OMI L5166 and E5001 have been revised to permit only the approved personnel under the suspended payload. The OMIs are available on site for inspection during the operation.

Alternate Standard Requirement #6

The suspended load operations addressed in this analysis involve one of the 30 ton SSPF bridge cranes. The cranes are designed, tested, inspected, maintained, and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9.

The SSPF 30 ton crane hoists are equipped with two magnetic holding brakes, each capable of holding the load up to the crane's rated capacity. Each brake's ability to hold the rated load (30 tons) is verified annually. The cranes are designed to meet a 5 to 1 safety factor based on ultimate strength for the hoist load bearing components. The 30 ton cranes are load tested annually at 100% of rated capacity. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on the cranes to ensure proper operation. A detailed inspection of the lifting slings is performed annually. Nondestructive testing of the slings and crane hooks is performed annually.

The Cargo Element Lifting Assembly (CELA) is rated at 26,500 lbs. and is designed to meet a 5 to 1 safety factor based on ultimate strength. The combined weight of the PMA and miscellaneous hoisting equipment is approximately 3,681 lbs.

Alternate Standard Requirement #7 - An SAA has been completed on the 30 ton bridge cranes in the SSPF. The SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis (see supporting documents). No critical single failure points were identified during this analysis.

Alternate Standard Requirement #8 - Visual inspections for cracks or other signs of damage or anomalies are performed on the hoist hooks, hoist beams, hoist cables, hoist rod assemblies, and hoist fittings, and crane functional checks are performed before each operation per NSS/GO-1740.9.

Alternate Standard Requirement #9 - Trained and licensed crane operators shall remain at the hoist controls while personnel are under the load.

Alternate Standard Requirement #10 - Appropriate safety control areas are established before initiating operations. Only the minimum number of people (manloaded in the procedure) will be permitted in this area.

Alternate Standard Requirement #11 - A pretask briefing and a safety walkdown of the area are conducted prior to the lift to ensure that all systems and personnel are ready to support. All participants are instructed on their specific tasks and warned of any hazards involved. Following any crew change, the new personnel are instructed by the task leader on their specific tasks and warned of any hazards involved.

Alternate Standard Requirement #12 - The personnel under the suspended load will be in voice contact with the hoist operator and/or task leader. Upon loss of communication, the operation shall stop immediately, personnel shall clear the hazardous area, and the load shall be safed. Operations shall not continue until communications are restored.

Alternate Standard Requirement #13 - Personnel working beneath the load shall be in continuous sight of the hoist operator and/or task leader.

APPROVAL: **DATE:**

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